INK JET RECORDING MEDIUM

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Abstract

PURPOSE:To enable the degree of spreading of dots to be optimally controlled, by a method wherein synthetic amorphous silica surface-treated with a silane coupling agent is incorporated in an ink-receiving layer as a pore-forming material.

CONSTITUTION:Synthetic amorphous silica surface-treated with a silane coupling agent is incorporated in the ink-receiving layer as a pore-forming material, thereby favorably controlling the degree of spreading of dots (which greatly affects the resolution) while maintaining a sufficient ink absorption rate and a sufficient ink absorption capacity. Synthetic amorphous silica generally has an extremely high specific surface area according to the BET method of 80-800m<2>/g, and by treating the pigment with a silane coupling agent, the affinity of the pigment for an ink vehicle can be adequately controlled while retaining the absorption capacity of the ink vehicle, and an ink-receiving layer having an appropriate dot-spreading property can be obtained.

(116362C)

Partial translation of Reference 2:

JP Patent Application Disclosure No. 60-224580 - November 8, 1985

Application No. 59-82468 - April 23, 1984

Applicant: Mitsubishi Seishi K.K., Tokyo, JP

Title: Inkjet recording medium

Claim (single claim):

Inkjet recording medium having an ink-receiving layer comprising synthetic amorphous silica and water-based adhesives on top of a substrate, characterized in that the synthetic amorphous silica is surface-treated with a silane coupling agent.

[Excerpt from the detailed description of the invention]

Though uncertain, the mechanism of how the synthetic amorphous silica surface-treated with a silane coupling agent according to the present invention can control the degree of the spreading of dots is assumed to be as follows:

In general, synthetic amorphous silica has a relatively large surface area according to BET method of 80 to 800m^2/g and coordinating hydroxyl groups on the surface, and it is very hydrophilic with a high adsorbing capacity of water. The ink-absorbing capacity becomes higher when using the synthetic amorphous silica for the ink-receiving layer, but at the same time, since the affinity for ink vehicle also becomes higher,

absorption and penetration competes with each other, and the absorption capacity and the degree of the spreading of dots are fixed by the surface area of the pigment used and the thickness of the ink-receiving layer. However, by treating the pigment to be used with silane coupling agent, as in the present invention, the affinity for ink vehicle can be adequately controlled without changing the absorption volume of the ink vehicle, and an ink-receiving layer with appropriate spreading can be obtained.

This is understandable when considering the affinity as the difference between the surface energy of the solid and the surface energy of the ink vehicle. In general, the affinity is high when the surface energy of a solid is close to or greater than that of a liquid, and as the surface energy of a solid becomes lower than that of a liquid, the lower the affinity becomes. As explained earlier, the surface of silica is considered to have affinity for water, and by providing surface-treatment thereto with a substance which is considered to lower the surface energy (ex. silane coupling agent), the affinity between the surface-treated pigment and the ink vehicle can also be lowered, and by controlling the difference of surface energy by the content of the surface-treating agent, the degree of the spreading of dots can also be controlled.

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Example 1:

100 parts of synthetic amorphous silica (Carplex #67,

manufactured by Shionogi Seiyaku) was dispersed in 400 parts of water, then 10 parts of a 5% aqueous solution of a silane coupling agent (γ-glycidoxypropyltrimethoxysilane, manufactured by Nippon Unicar) was added under vigorous stirring, and vigorous stirring was continued for another 30 minutes. The mixture was allowed to stand, filtered after removing the supernatant, and the remaining cake was dried by hot air of 105°C. After drying, the cake was dry-crushed to obtain a silane-coupling-agent-treated pigment. 100, 70, and 40 parts of the silane-coupling-agent-treated pigment were each mixed with 0, 30, and 60 parts of precipitated calcium carbonate (Unibar70 (phonetic), manufactured by Shiraishi Kogyo) respectively, then 20 parts of polyvinylalcohol (PVA117, manufactured by Kuraray) were added obtain a coating liquid with 18% concentration. The mixture was coated and dried so that the dry solid content would be $13g/m^2$ with an air knife coater, and then the surface was smoothed by a super calender to obtain recording sheets of Examples 1, 2 and 3. The result of the evaluation of the obtained recording sheets is show in Table 1.

Comparative Example 1:

100 parts of precipitated calcium carbonate (Unibar70 (phonetic), manufactured by Shiraishi Kogyo) were used instead of using the silane-coupling-agent-treated pigment of Examples 1 to 3. 20 parts of polyvinylalcohol were added, and then a recording sheet of Comparative Example 1 was produced following the same finishing process as in Examples 1 to 3. The result

of the evaluation of Comparative Example 1 is shown in Table 1.

Examples 4 to 6:

100 parts of synthetic amorphous silica (Syloid404, manufactured by Fuji Davison Kagaku) were dispersed in 400 parts of water to obtain a slurry, then 1, 2 and 5 parts of 5% aqueous solution of a silane coupling agent (γ-aminopropyltriethoxysilane, manufactured by Nippon Unicar) were added respectively under vigorous stirring, and then reacted under vigorous stirring for another 30 minutes. Polyvinylalcohol (PVA117, manufactured by Kuraray) dissolved to 10% was added to the slurry in an amount of 30 parts based on the solid content, and then the mixture was stirred thoroughly to obtain a coating liquid. This coating liquid was coated onto art paper so that the coating amount would be $15g/m^2$ based on the solid content, and then the surface of the paper was smoothed through super calender after drying to obtain Examples 4, 5 and 6. The result of the evaluation thereof is shown in Table 1.

Comparative Example 2:

Recording sheet of Comparative Example 2 was produced according to the same process as in Examples 4, 5 and 6, except that synthetic amorphous silica slurry containing no silane coupling agent was used. The result of the evaluation thereof is shown in Table 1.

Table 1:

	Dot diameter (μm)	Inc absorption volume (g/m^2)	Inc absorbing speed
Example			
1	181	25.3	◎
2	195	24.1	◎
3	208	23.3	◎
4	216	24.3	◎
5	201	23.5	◎
6	179	23.9	◎
Comparative Example			
1	305	22.3	◎
2	283	24.2	◎

Table 1 shows that dot diameters can be kept small while maintaining good ink absorption volume in Examples 1 to 6 using synthetic amorphous silica surface-treated with a silane coupling agent.